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Miyazawa

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(54) **COMMUNICATION SYSTEM FOR RECEIVING AUTHENTICATION DATA FROM AN EXTERNAL SERVICE**

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G06F 15/16 (2006.01)
H04L 29/08 (2006.01)
H04L 29/06 (2006.01)

(52) **U.S. Cl.**
CPC ***H04L 67/16*** (2013.01); ***H04L 63/08*** (2013.01); ***H04L 67/2814*** (2013.01)

(58) **Field of Classification Search**
CPC H04L 63/08; H04L 67/2814; H04L 67/16
USPC 726/4; 358/1.15, 1.14; 709/217, 223, 709/220, 227
See application file for complete search history.

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(57) **ABSTRACT**

A communication system includes a communication device and a relay apparatus that are connected to a network with an external service. The communication device includes a communication unit connected to a browser-installed device and a controller configured to transmit data location information to the browser installed device and output location of the communication device. The relay apparatus includes a communication unit and a controller configured to receive a request, transmit predetermined data based on the request, get the communication-device location information, instruct the browser-installed device to output the communication-device location information, receive authentication data, get the communication-device location information or the correspondence information output by the browser-installed device, and instruct the browser-installed device to transmit the authentication data to the communication device.

18 Claims, 13 Drawing Sheets

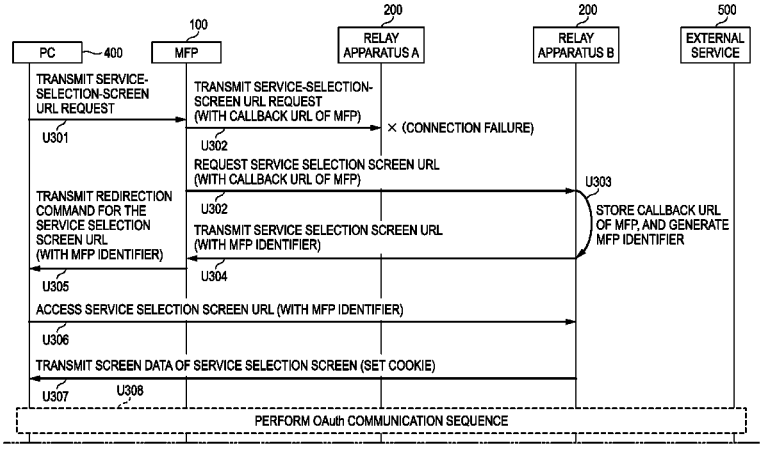


FIG. 1

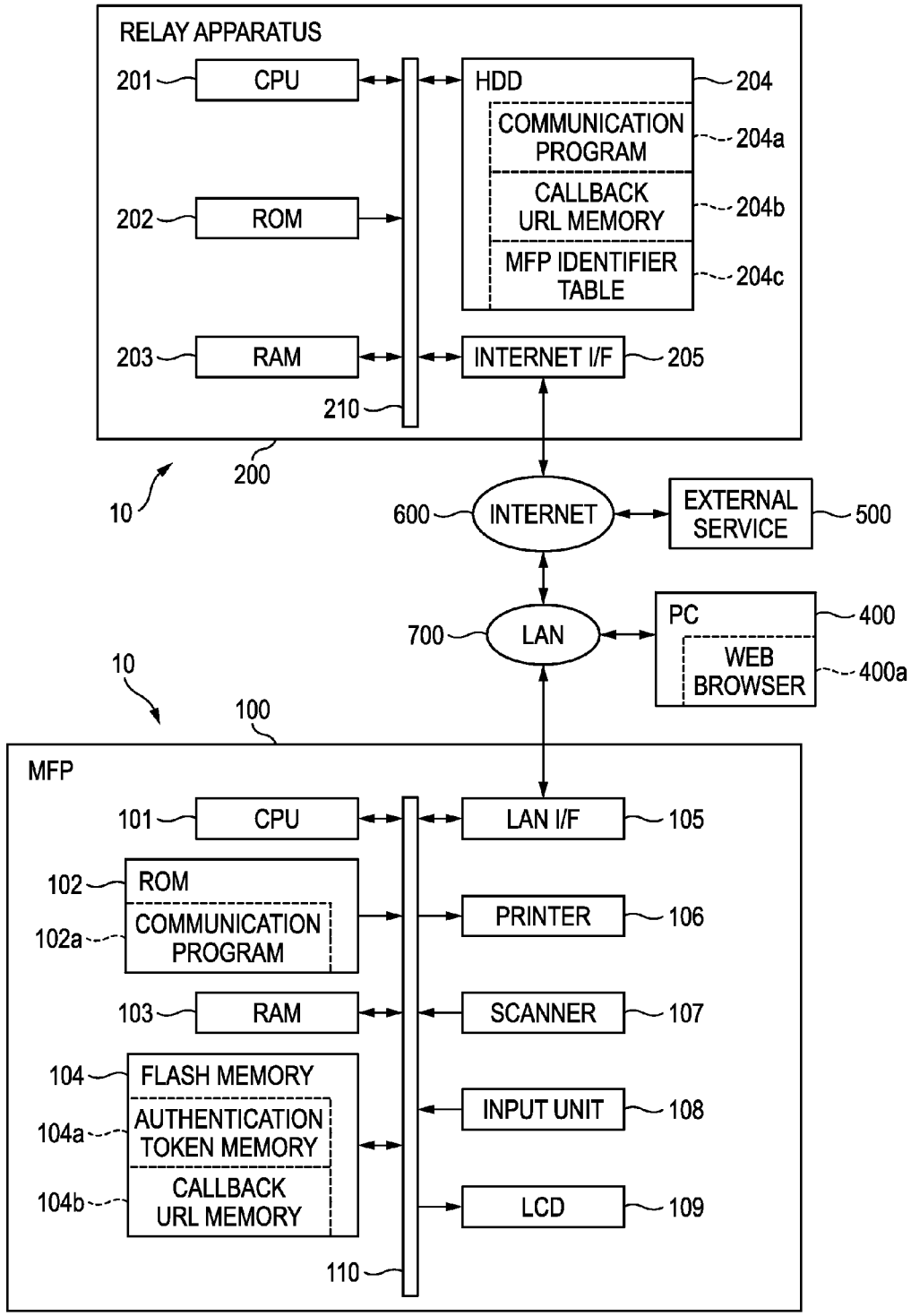

RELAY APPARATUS
201
CPU
202
ROM
203
RAM
210
HDD
204
COMMUNICATION PROGRAM
204a
CALLBACK URL MEMORY
204b
MFP IDENTIFIER TABLE
204c
INTERNET I/F
205
200
10
600
INTERNET
EXTERNAL SERVICE
500
700
LAN
PC
400
WEB BROWSER
400a
10
100
MFP
101
CPU
102
ROM
102a
COMMUNICATION PROGRAM
103
RAM
104
FLASH MEMORY
104a
AUTHENTICATION TOKEN MEMORY
104b
CALLBACK URL MEMORY
110
LAN I/F
105
PRINTER
106
SCANNER
107
INPUT UNIT
108
LCD
109

FIG. 2

EXAMPLE OF MFP IDENTIFIER TABLE 204c

MFP IDENTIFIER	CALLBACK URL OF MFP
A A A	http://10.163.20.43/MFP123
B B B	http://10.163.30.53/MFP567
C C C	http://10.163.40.63/MFP890
⋮	

FIG. 3

FIG. 3A
FIG. 3B

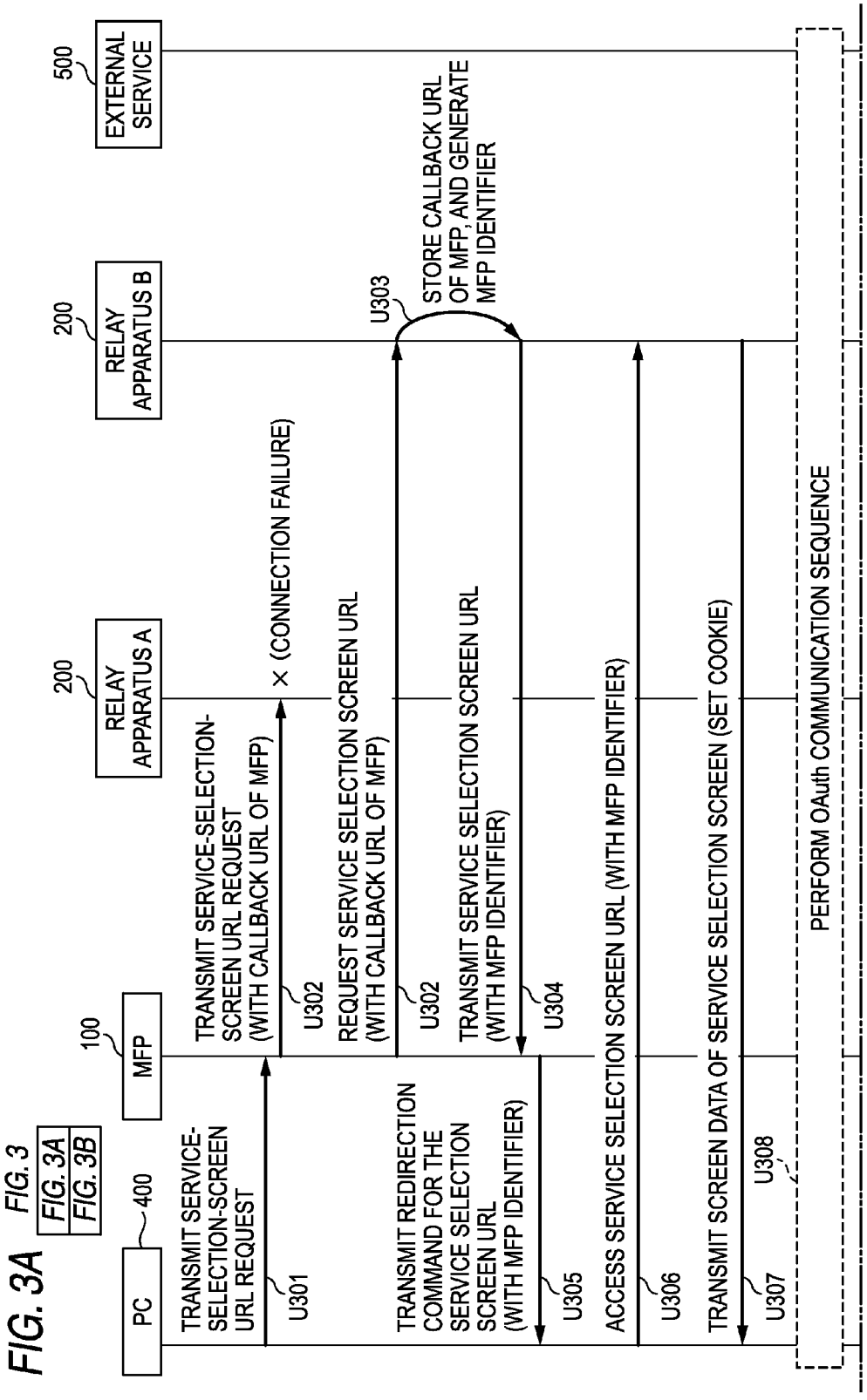


FIG. 3B

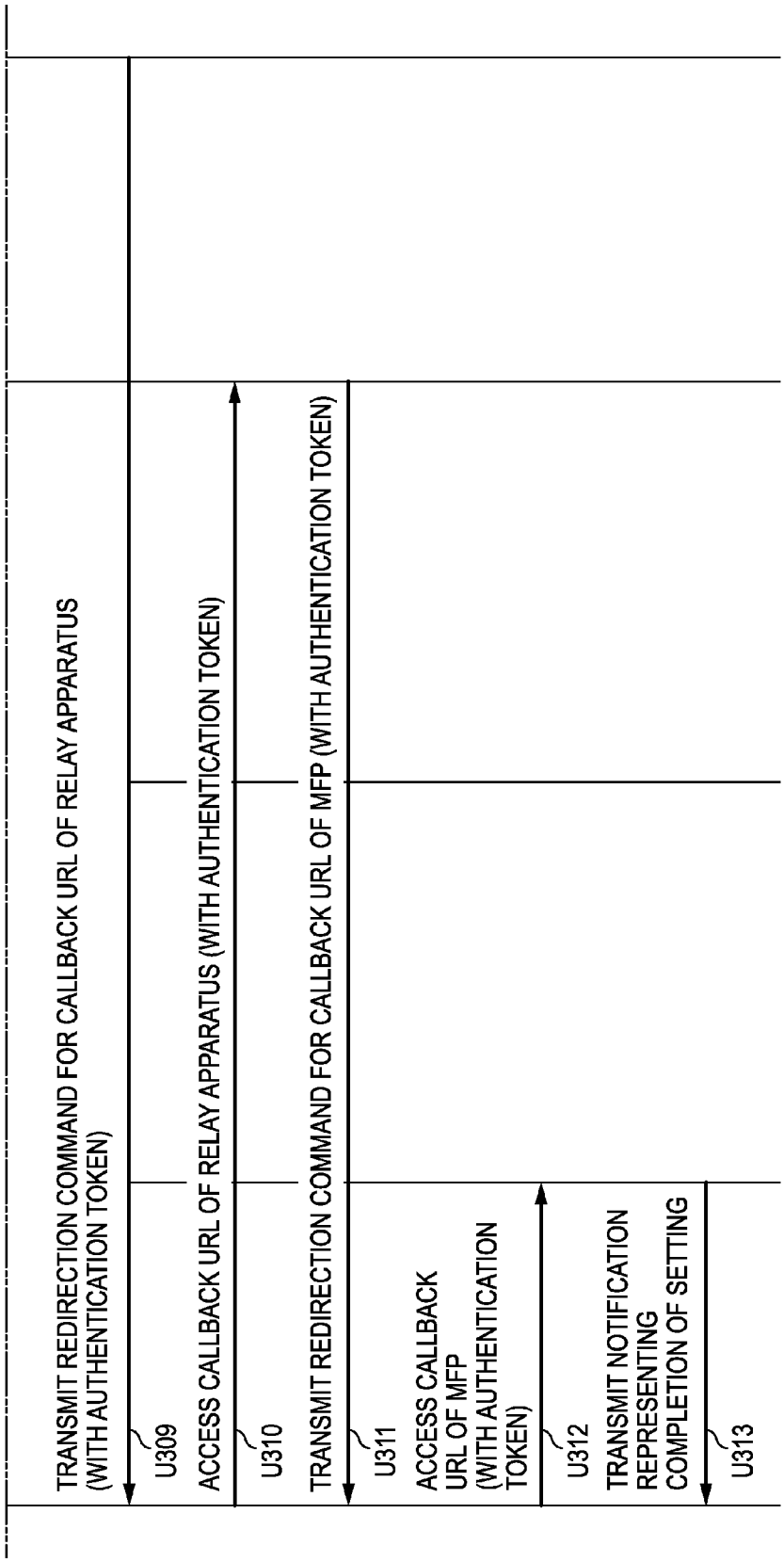
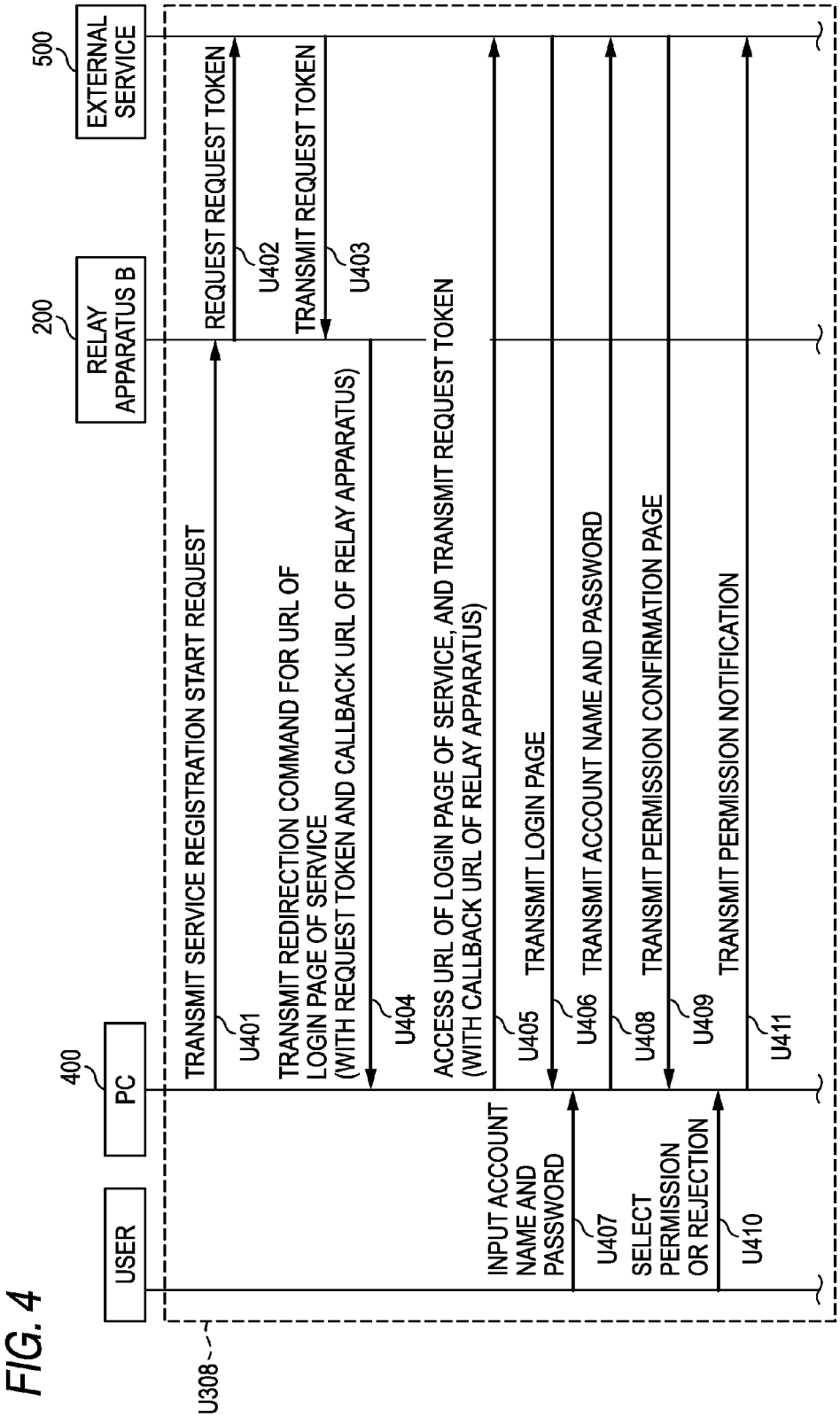

TRANSMIT REDIRECTION COMMAND FOR CALLBACK URL OF RELAY APPARATUS (WITH AUTHENTICATION TOKEN)
U309
ACCESS CALLBACK URL OF RELAY APPARATUS (WITH AUTHENTICATION TOKEN)
U310
TRANSMIT REDIRECTION COMMAND FOR CALLBACK URL OF MFP (WITH AUTHENTICATION TOKEN)
U311
ACCESS CALLBACK URL OF MFP (WITH AUTHENTICATION TOKEN)
U312
TRANSMIT NOTIFICATION REPRESENTING COMPLETION OF SETTING
U313

FIG. 4


USER
400
PC
200
RELAY APPARATUS B
500
EXTERNAL SERVICE
U308
TRANSMIT SERVICE REGISTRATION START REQUEST
U401
REQUEST REQUEST TOKEN
U402
TRANSMIT REQUEST TOKEN
U403
TRANSMIT REDIRECTION COMMAND FOR URL OF LOGIN PAGE OF SERVICE (WITH REQUEST TOKEN AND CALLBACK URL OF RELAY APPARATUS)
U404
ACCESS URL OF LOGIN PAGE OF SERVICE, AND TRANSMIT REQUEST TOKEN (WITH CALLBACK URL OF RELAY APPARATUS)
U405
TRANSMIT LOGIN PAGE
INPUT ACCOUNT NAME AND PASSWORD
U406
TRANSMIT ACCOUNT NAME AND PASSWORD
U407
U408
TRANSMIT PERMISSION CONFIRMATION PAGE
SELECT PERMISSION OR REJECTION
U409
TRANSMIT PERMISSION NOTIFICATION
U410
U411

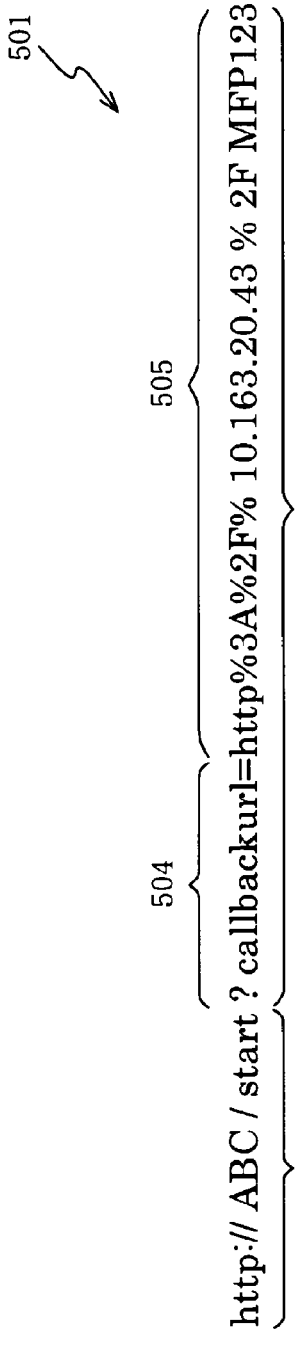


FIG. 5A

FIG. 5B

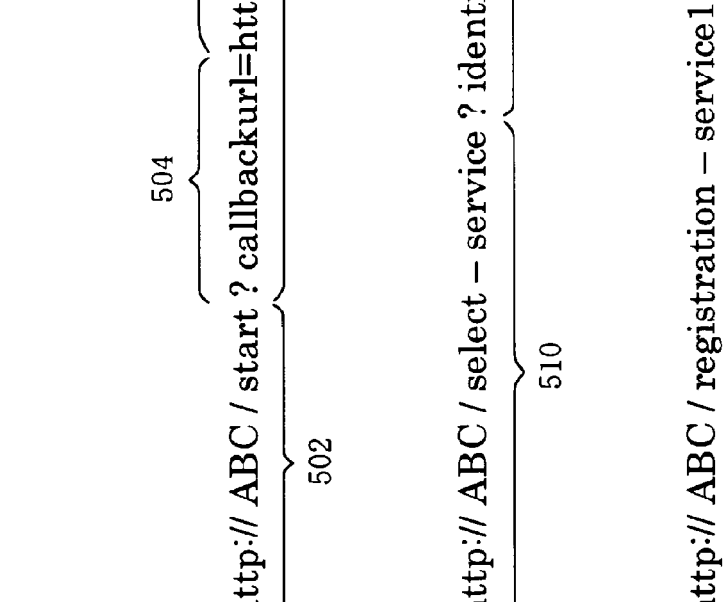


FIG. 5C

FIG. 5D

FIG. 6A

FIG. 6

FIG. 6A
FIG. 6B

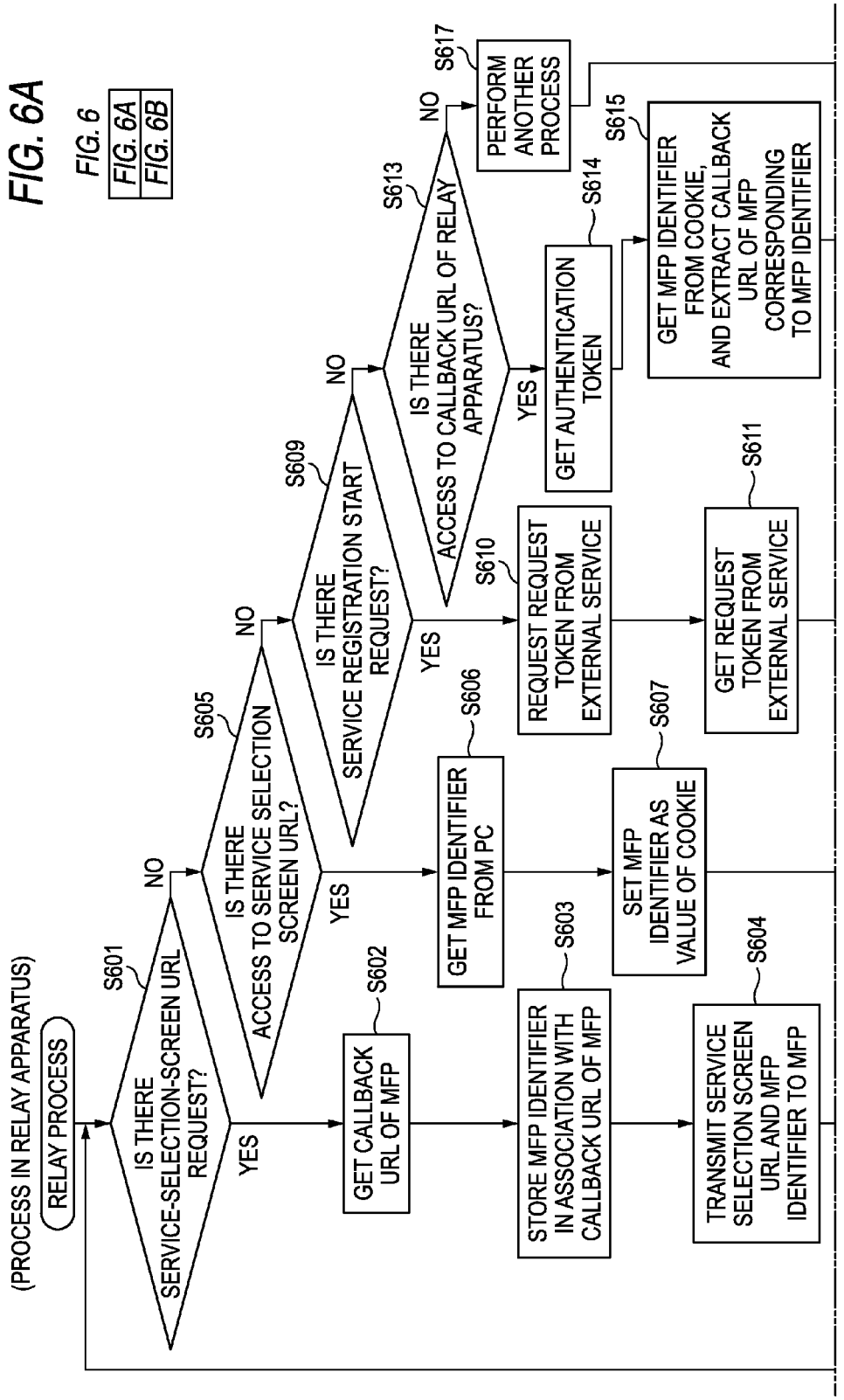


FIG. 6B

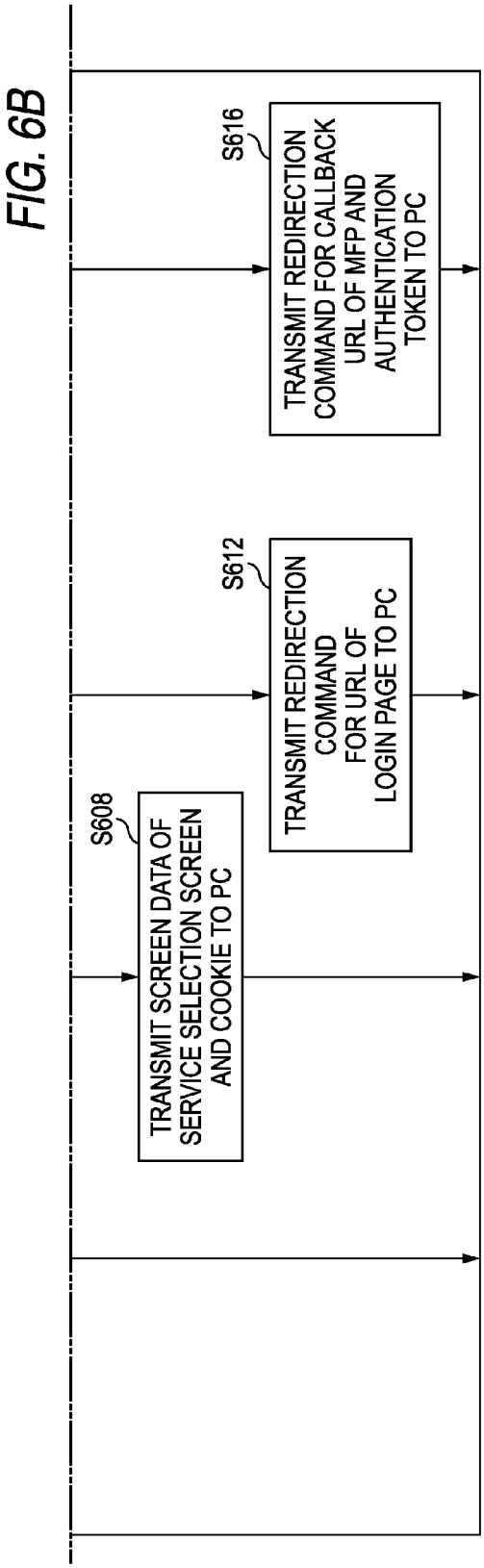

S608
TRANSMIT SCREEN DATA OF SERVICE SELECTION SCREEN AND COOKIE TO PC
S612
TRANSMIT REDIRECTION COMMAND FOR URL OF LOGIN PAGE TO PC
S616
TRANSMIT REDIRECTION COMMAND FOR CALLBACK URL OF MFP AND AUTHENTICATION TOKEN TO PC

FIG. 7

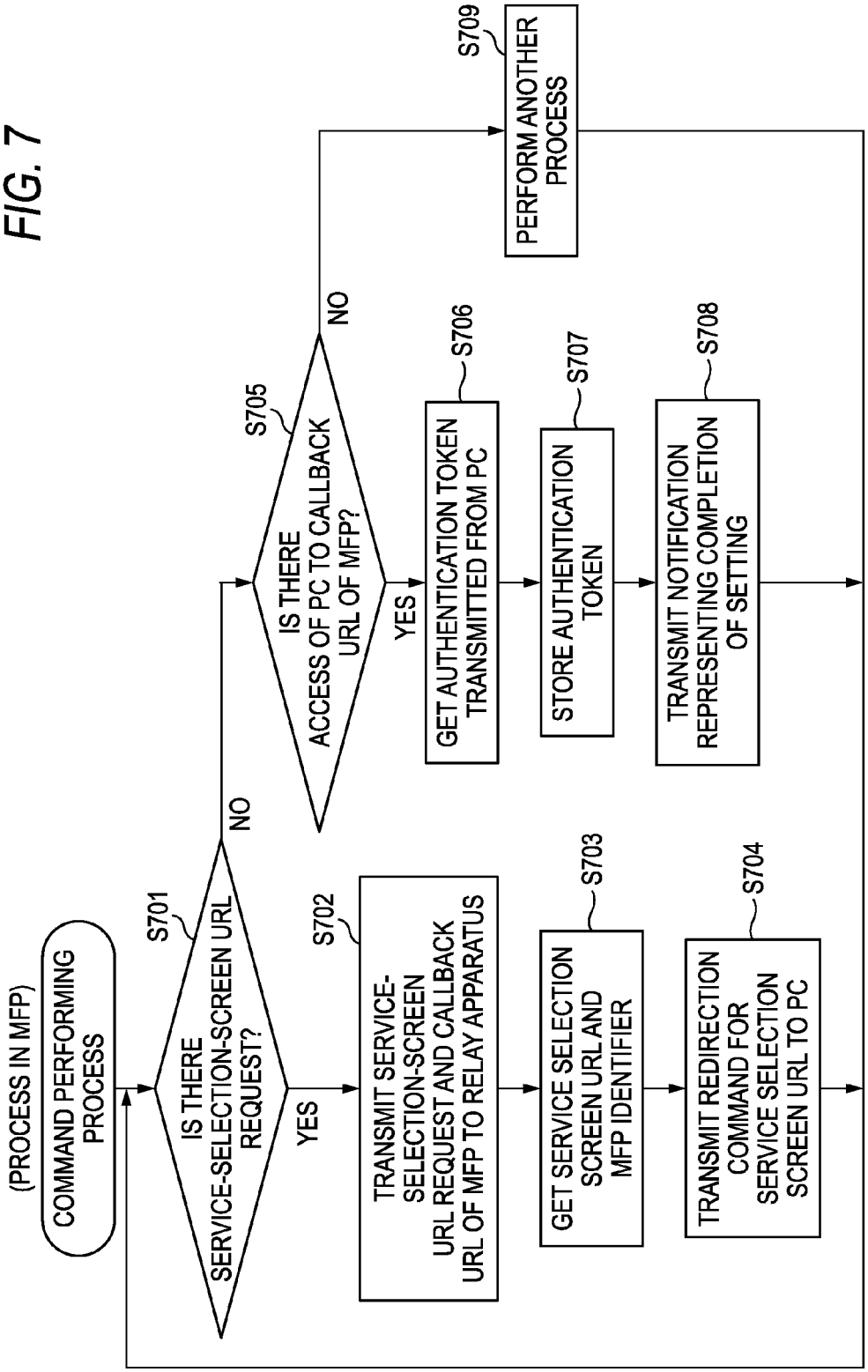

(PROCESS IN MFP)
COMMAND PERFORMING PROCESS
S701
IS THERE SERVICE-SELECTION-SCREEN URL REQUEST?
YES
NO
S702
TRANSMIT SERVICE-SELECTION-SCREEN URL REQUEST AND CALLBACK URL OF MFP TO RELAY APPARATUS
S703
GET SERVICE SELECTION SCREEN URL AND MFP IDENTIFIER
S704
TRANSMIT REDIRECTION COMMAND FOR SERVICE SELECTION SCREEN URL TO PC
S705
IS THERE ACCESS OF PC TO CALLBACK URL OF MFP?
YES
NO
S706
GET AUTHENTICATION TOKEN TRANSMITTED FROM PC
S707
STORE AUTHENTICATION TOKEN
S708
TRANSMIT NOTIFICATION REPRESENTING COMPLETION OF SETTING
S709
PERFORM ANOTHER PROCESS

FIG. 8A

FIG. 8 FIG. 8A FIG. 8B

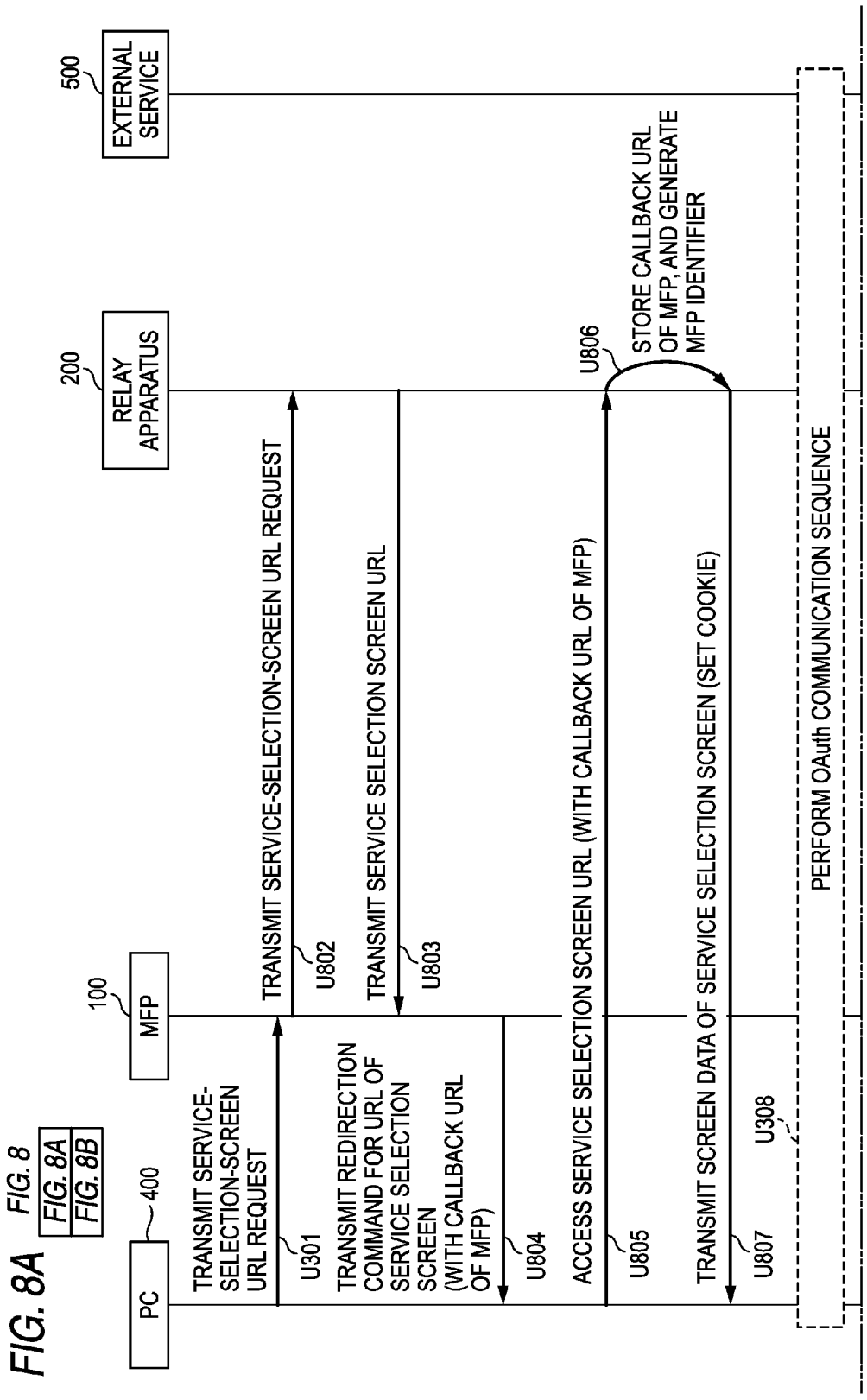


FIG. 8B

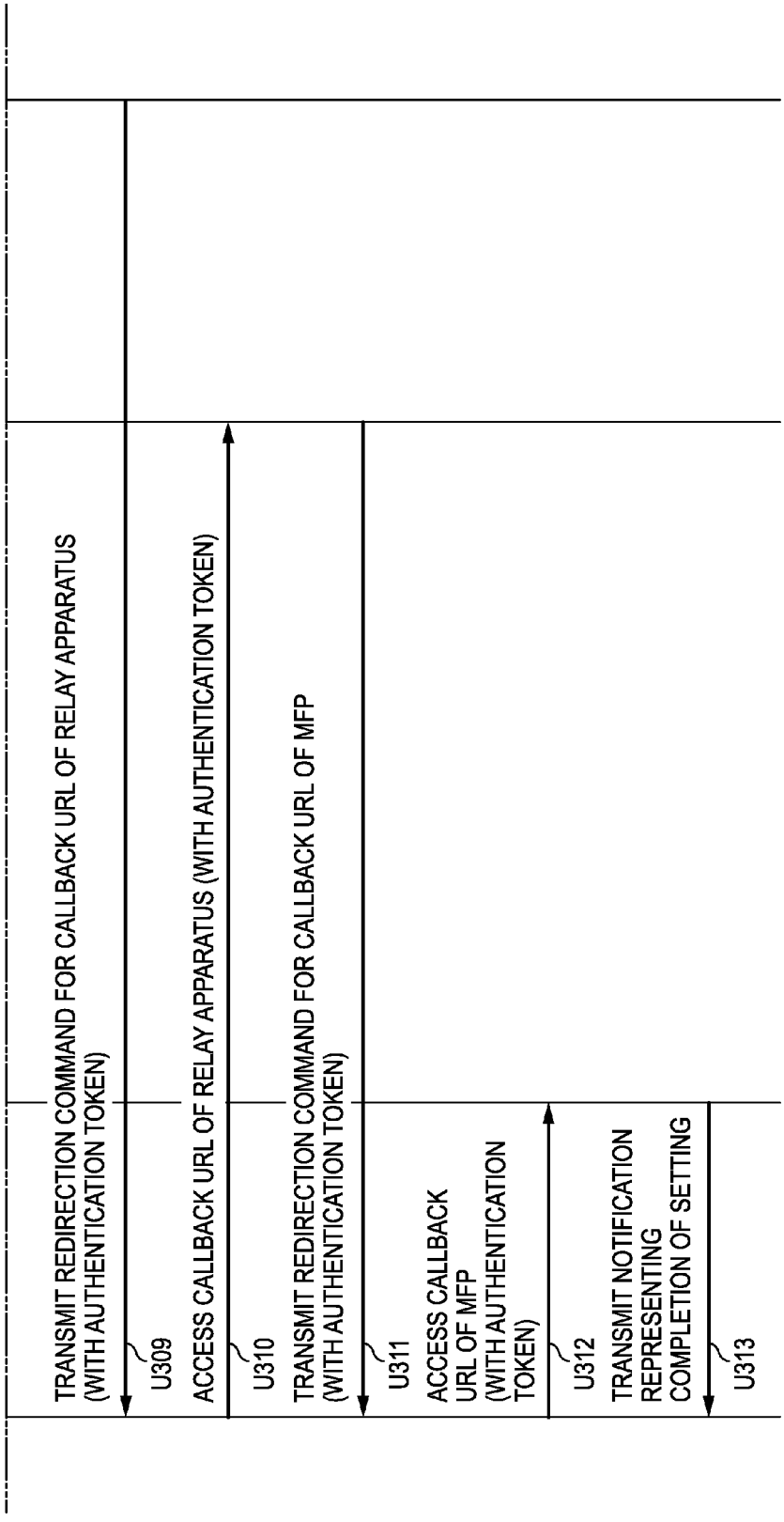
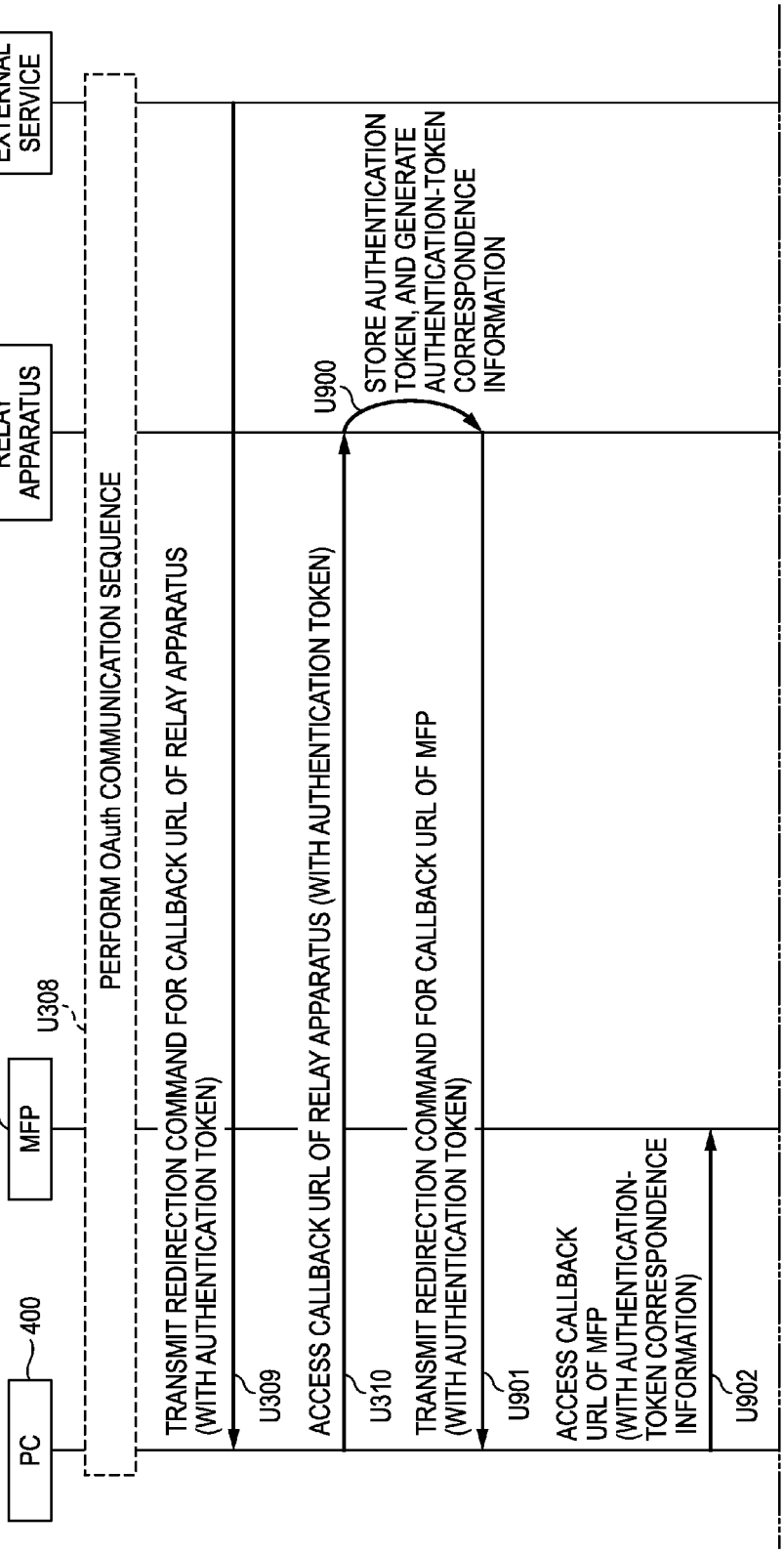

TRANSMIT REDIRECTION COMMAND FOR CALLBACK URL OF RELAY APPARATUS (WITH AUTHENTICATION TOKEN)
U309
ACCESS CALLBACK URL OF RELAY APPARATUS (WITH AUTHENTICATION TOKEN)
U310
TRANSMIT REDIRECTION COMMAND FOR CALLBACK URL OF MFP (WITH AUTHENTICATION TOKEN)
U311
ACCESS CALLBACK URL OF MFP (WITH AUTHENTICATION TOKEN)
U312
TRANSMIT NOTIFICATION REPRESENTING COMPLETION OF SETTING
U313

FIG. 9A

FIG. 9 FIG. 9A FIG. 9B



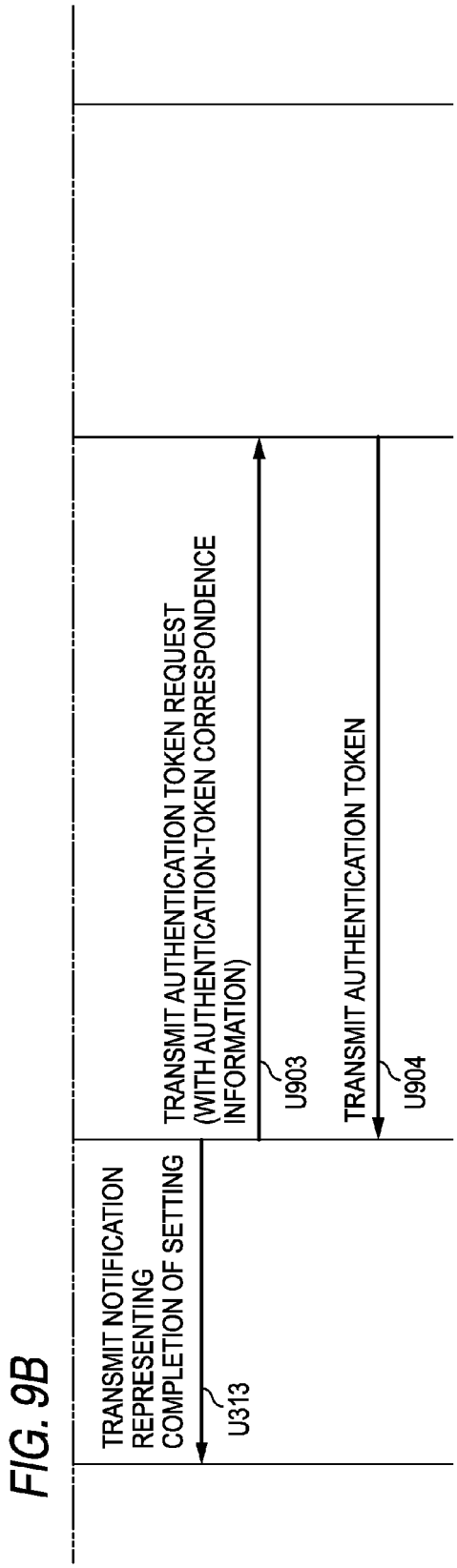

TRANSMIT NOTIFICATION REPRESENTING COMPLETION OF SETTING
U313
TRANSMIT AUTHENTICATION TOKEN REQUEST (WITH AUTHENTICATION-TOKEN CORRESPONDENCE INFORMATION)
U903
TRANSMIT AUTHENTICATION TOKEN
U904

FIG. 9B

COMMUNICATION SYSTEM FOR RECEIVING AUTHENTICATION DATA FROM AN EXTERNAL SERVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority from Japanese Patent Application No. 2011-194455 filed on Sep. 7, 2011, the entire subject matter of which is incorporated herein by reference.

TECHNICAL FIELD

The present invention relates to a communication system.

BACKGROUND

There have been proposed an image reading apparatus for uploading an electronic file of a read image to a server. There have been proposed a printer for printing an electronic file downloaded from a server. In order to provide those services, makers of the image reading apparatus and the printer may provide dedicated servers on their own.

Web services capable of storing electronic files in databases prepared on networks by service providers have been in widespread use. For example, a Picasa (a registered trademark) web album and flickr (a registered trademark) are examples of the web services. Users can use communication devices having web browsers to upload or download desired electronic files in the web services.

Thus, the makers of image reading apparatuses or printers may configure the image reading apparatuses and the printers to be capable of direly using those web services, instead of providing the dedicated servers.

SUMMARY

In order to use those web services from apparatuses such as the image reading apparatuses and the printers, prior to using of the services, the apparatuses such as the image reading apparatuses and printers may need to conduct authentication with the web services, so as to get access permission from the web services. However, the authentication with the web services is generally conducted by using web browsers. Thus, it is difficult to get authentication data through an apparatus such that an image reading apparatus or a printer having no web browser.

Therefore, illustrative aspects of the present invention provide a communication system capable of making a communication device easily get authentication data of an external service, regardless of whether the communication device has a web browser or not.

According to one illustrative aspect of the present invention, there is provided a communication system comprising a communication device and a relay apparatus. The communication device and the relay apparatus are connected to a network that an external service is connected to. The communication device comprises: a communication unit configured to be connected to the network and to a browser-installed device, which comprises a browser unit and is connected to the network; and a controller. The controller of the communication device is configured to perform: a first transmitting process of transmitting data location information representing a location of predetermined data to the browser-installed device in response to a request from the browser-installed device connected by the communication unit; and an outputting process of outputting communication-device location information representing a location of the communication device. The relay apparatus comprises: a communication unit configured to be connected to the network; and a controller. The controller of the relay apparatus is configured to perform: a first receiving process of receiving a request based on the data location information from the browser-installed device; a second transmitting process of transmitting the predetermined data to the browser-installed device in response to the request based on the data location information received by the first receiving process; a first getting process of getting the communication-device location information output by the communication device that is connected to the browser-installed device which has transmitted the predetermined data; a first instructing process of instructing the browser-installed device to output the communication-device location information, which is communication-device location information of the communication device connected to the browser-installed device and is got by the first getting process, or correspondence information corresponding to the communication-device location information, to the relay apparatus; a second receiving process of receiving authentication data of the external service transmitted from the browser-installed device; a second getting process of getting the communication-device location information or the correspondence information corresponding to the communication-device location information output by the browser-installed device when the second receiving process receives the authentication data; and a second instructing process of instructing the browser-installed device to transmit the authentication data to the communication device represented by the communication-device location information got by the second getting process.

Incidentally, the present invention can implement a communication method, a communication device or a relay apparatus configuring a communication system, a control device for controlling a communication device or a relay apparatus, a program that is executable in a communication device or a relay apparatus, a recording medium for recording the program, and the like, in various forms.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram schematically illustrating an electrical configuration of a service cooperation system according to an exemplary embodiment of the present invention;

FIG. **2** is a view illustrating an example of a structure of a multi-function-peripheral (MFP) identifier table;

FIGS. **3**A and **3**B are sequence diagrams illustrating an authentication-token getting sequence;

FIG. **4** is a sequence diagram illustrating an OAuth communication sequence;

FIGS. **5**A to **5**D are views illustrating structures of URLs that a relay apparatus receives;

FIGS. **6**A and **6**B are flow charts illustrating a rely process that the relay apparatus executes;

FIG. **7** is a flow chart illustrating a command performing process that the MFP executes;

FIGS. **8**A and **8**B are sequence diagrams illustrating an authentication-token getting sequence according to a second exemplary embodiment; and

FIGS. **9**A and **9**B are sequence diagrams illustrating an authentication-token getting sequence according to a third exemplary embodiment.

DETAILED DESCRIPTION

Exemplary embodiments of the present invention will now be described with reference to the accompanying drawings.

FIG. **1** is a block diagram schematically illustrating an electrical configuration of a service cooperation system **10** according to a first exemplary embodiment of a communication system of the present invention. The service cooperation system **10** includes a multi-function peripheral **100** (hereinafter, referred to as an MFP **100**) and a relay apparatus **200**. The multi-function peripheral **100** has a digital multi-function peripheral having a printing function, a scanner function, a fax function, and a copy function. The relay apparatus **200** is a server provided by the maker of the MFP **100**. A PC **400** is a personal computer owned by a user of the MFP **100**. An external service **500** is a web server provided by a service provider. The service cooperation system **10** of the present exemplary embodiment is configured such that, even if the MFP **100** has no web browser, the MFP **100** can easily get an authentication token of the external service **500**. The details will be described below.

The MFP **100**, the relay apparatus **200**, the PC **400**, and the external service **500** are connected to one another through the Internet **600** and are configured to perform data transmission and reception with one another in accordance with HTTP. The Internet **600** may be made of an internet network. Further, the MFP **100** and the PC **400** are connected to each other a LAN **700**, and are also connected to the Internet **600** through the LAN **700**. On the Internet **600**, a plurality of kinds of external services **500** exists; however, one external service **500** is shown in FIG. **1**.

The MFP **100** includes a CPU **101**, a ROM **102**, a RAM **103**, a flash memory **104**, a LAN interface (I/F) **105**, a printer **106**, a scanner **107**, an input unit **108**, and a liquid crystal device (LCD) **109**, which are connected to one another through bus lines **110**.

The CPU **101** executes processes in accordance with programs stored in the ROM **102**. The ROM **102** is a memory for storing programs and the like for controlling an operation of the MFP **100**. The ROM **102** stores a communication program **102***a*. The MFP **100** executes a command performing process (FIG. **7**) (which will be described later) in accordance with the communication program **102***a*. The communication program **102***a* is a program for performing data transmission and reception according to HTTP, and acts as an XML parser for interpreting XML; however, the communication program **102***a* does not act as an HTML parser for interpreting HTML. In the present exemplary embodiment, it is assumed that the MFP **100** is unable to interpret information written in HTML so as not to display web pages provided by the external service **500**.

The RAM **103** temporarily stores information necessary for the processes of the CPU **101**. The flash memory **104** is a non-volatile memory. The flash memory **104** includes an authentication token memory **104***a* and a callback URL memory **104***b*. The details will be described below with reference to FIG. **3**. If the PC **400** performs an authentication procedure with the external service **500** in accordance with OAuth that is an example of an authentication protocol, the external service **500** issues an authentication token representing permission for resource use. The MFP **100** gets the authentication token of the external service **500** through the PC **400** and stores the authentication token in the authentication token memory **104***a*. Next, the MFP **100** uses the authentication token to use a resource of the external service **500**.

The callback URL memory **104***b* stores an URL (hereinafter, referred to as a callback URL of the MFP) set as an URL representing the location of the MFP **100** in order for the MFP **100** to get an authentication token.

The LAN I/F **105** is an interface for performing communication with another apparatus through the LAN **700**. The LAN I/F **105** connects the MFP **100** and the PC **400** through the LAN. The printer **106** is an apparatus for printing images. The scanner **107** is an apparatus for reading images. The input unit **108** is composed of operation keys or a touch panel for inputting an instruction or information to the MFP **100**. The LCD **109** displays various kinds of information.

The relay apparatus **200** includes a CPU **201**, a ROM **202**, a RAM **203**, a hard disk drive (HDD) **204**, and an Internet interface (I/F) **205**, which are connected to one another through bus lines **210**.

The CPU **201** executes processes in accordance with programs which are stored in the ROM **202** or the HDD **204**. The ROM **202** stores programs and the like for controlling an operation of the relay apparatus **200**. The RAM **203** temporarily stores data necessary for the processes of the CPU **201**.

The HDD **204** is a rewritable non-volatile storage device. The HDD **204** includes a communication program **204***a*, a callback URL memory **204***b*, and an MFP identifier table **204***c*. The communication program **204***a* is a program for transmitting and receiving HTTP messages. The relay apparatus **200** performs a relay process (FIG. **6**) (which will be described later) in accordance with that communication program **204***a*.

In the callback URL memory **204***b*, an URL (hereinafter, referred to as a callback URL of the relay apparatus) for enabling the relay apparatus **200** to receive an authentication token from the PC **400** is set. The MFP identifier table **204***c* is a table that stores the callback URL of the MFP. The MFP identifier table **204***c* will be described below with reference to FIG. **2**. The Internet I/F **205** is a unit for performing communication with another apparatus connected to the Internet **600**.

The PC **400** includes a web browser **400***a* installed therein. The PC **400** is configured to be capable of displaying web pages that are provided by various web servers such as the external service **500**. In the service cooperation system **10** of the present exemplary embodiment, the PC **400** performs an authentication procedure through the relay apparatus **200**.

FIG. **2** is a view schematically illustrating the structure of the MFP identifier table **204***c* provided in the relay apparatus **200**. The details will be described below with reference to FIG. **3**, but the relay apparatus **200** gets the callback URL of the MFP connected with the PC **400** through the LAN, through the PC **400**. Then, the relay apparatus **200** stores an arbitrary character string (hereinafter, referred to as an MFP identifier) in association with the got callback URL in the MFP identifier table **204***c*.

The MFP identifier may be stored as a value of a cookie in the PC **400** that is a client. Then, when the PC **400** transmits data to the relay apparatus **200** for the second or subsequent time, the PC **400** transmits the MFP identifier as the value of the cookie to the relay apparatus **200**. Therefore, on the basis of the MFP identifier, the relay apparatus **200** can get the callback URL of the MFP **100** connected to the PC **40**.

FIG. **3** is a sequence diagram illustrating an authentication-token getting sequence that is performed among the PC **400**, the MFP **100**, the relay apparatus **200**, and the external service **500**. It is assumed that, prior to starting that process, the user connects the PC **400** to the external service **500** so as to make the external service **500** issue an account name and a password. Incidentally, requests and responses are included in HTTP messages, which are transmitted and received among the apparatuses shown in FIG. **3**.

First, in STEP U**301**, the PC **400** transmits an HTTP message to request a URL (hereinafter, referred to as a service selection screen URL) representing the location of screen data for displaying a service selection screen, to the MFP **100** connected with the PC **400** through the LAN. In response to

the request from the PC **400**, in STEP U**302**, the MFP **100** transmits a service-selection-screen URL request to the relay apparatus **200**.

FIG. **5**A is a view illustrating an example of a designation URL included in the service-selection-screen URL request. As shown in FIG. **5**A, a designation URL **501** includes a request reception URL **502** and a query character string **503**. The MFP **100** stores the request reception URL **502** for enabling the relay apparatus **200** to receive the service-selection-screen URL request, in advance. Then, the MFP **100** adds the query character string **503** including the callback URL of the MFP as a parameter, to the request reception URL **502** stored in advance, so as to generate the designation URL **501**. The MFP **100** outputs the service-selection-screen URL request to the generated designation URL.

The query character string **503** includes: a character string **504** representing that the query character string **503** includes the callback URL; and a callback URL **505**. However, due to limitation of HTTP, there is a restriction on the kinds of characters that can be included in the query character string **503**. Therefore, the MFP **100** performs URL encoding on the callback URL of the MFP to generate the callback URL **505** so that the query character string **503** includes the encoded callback URL **505**.

Referring to FIG. **3** again, the description will continue. In the example shown in FIG. **3**, as the relay apparatus **200**, relay apparatuses A and B are shown. All of the relay apparatuses A and B are severs installed by the maker of the MFP **100**, and provide the same service; however, in the example of FIG. **3**, it is assumed that the relay apparatus A is inaccessible due to disruption, and the relay apparatus B is accessible. In this case, the MFP **100** transmits the service-selection-screen URL request to the relay apparatus B and gets the service selection screen URL from the relay apparatus B. Hereinafter, the relay apparatus B that the MFP **100** was capable of accessing will be referred to simply as the relay apparatus **200**.

When receiving the service-selection-screen URL request from the MFP **100**, the relay apparatus **200** decodes the callback URL **505** of the designation URL **501** (FIG. **5**A) included in the corresponding request so as to get the callback URL of the MFP. Then, in STEP U**303**, the relay apparatus **200** generates an MFP identifier corresponding to the callback URL of the MFP and stores the MFP identifier in association with the callback URL of the MFP in the MFP identifier table **204***c*. Next, in STEP U**304**, the relay apparatus **200** adds the MFP identifier to the service selection screen URL and transmits the service selection screen URL to the MFP **100**.

FIG. **5**B is a view illustrating an example of a service selection screen URL having an MFP identifier added thereto. As shown in FIG. **5**B, the relay apparatus **200** may add a query character string **511** designating an MFP identifier 'AAA' as a parameter, to the end of a service selection screen URL **510**, so that the relay apparatus **200** is capable of transmitting the MFP identifier to the MFP **100**.

Referring to FIG. **3** again, the description will continue. When the MFP **100** gets the service selection screen URL including the MFP identifier from the relay apparatus **200**, in STEP U**305**, the MFP **100** transmits a redirection command including the service selection screen URL to the PC **400**. In STEP U**306**, in accordance with the redirection command, the PC **400** accesses the service selection screen URL of the relay apparatus **200** and requests a service selection screen. Therefore, according to the present exemplary embodiment, since the MFP **100** gets the service selection screen URL from the relay apparatus **200** and transmits the service selection screen URL to the PC **400**, the PC **400** can access the relay apparatus **200** having been accessed by the MFP **100** on the basis of the service selection screen URL. In other words, even in a distributed environment where a plurality of relay apparatuses **200** exist, the PC **400** can request a service selection screen from the relay apparatus **200** (the relay apparatus B in the example shown in FIG. **3**) storing the MFP identifier and the callback URL of the MFP.

Upon receiving the request based on the service selection screen URL including the MFP identifier, from the PC **400**, the relay apparatus **200** extracts the MFP identifier from the query character string **511** (see FIG. **5**B) included in the service selection screen URL **510**. Then, in STEP U**307**, the relay apparatus **200** transmits screen data for displaying a service selection screen composed of a web page, to the PC **400**. In other words, the relay apparatus **200** makes the PC **400** get the screen data stored in advance in the HDD **204**. Here, when transmitting the screen data, the relay apparatus **200** sets a cookie, and when the PC **400** transmits the HTTP message to the relay apparatus **200**, the relay apparatus **200** instructs the web browser **400***a* of the PC **400** to output the MFP identifier as the value of the cookie.

As a result, in STEP U**307** and the subsequent steps, the relay apparatus **200** can transmit an MFP identifier whenever receiving an HTTP message from the PC **400**, and can get the callback URL of the MFP connected with the PC **400** through the LAN on the basis of the MFP identifier.

The PC **400** displays the service selection screen using the screen data having been received from the relay apparatus **200** and performs an authentication procedure with the external service **500** selected in the service selection screen by the user. An OAuth communication sequence of STEP U**308** representing the detailed sequence of the authentication procedure will be described later with reference to FIG. **4**.

If the authentication procedure between the PC **400** and the external service **500** is successful, in STEP U**309**, the external service **500** transmits a redirection command for the relay apparatus **200**, to the PC **400**. This redirection command includes the authentication token issued by the external service and the callback URL of the relay apparatus. For example, the authentication token is added as a query character string to the callback URL of the relay apparatus.

In STEP U**310**, the PC **400** receives the redirection command from the external service **500**, accesses the relay apparatus **200** and transmits the authentication token to the relay apparatus **200**. This can be implemented, for example, by connecting the PC **400** to the callback URL of the relay apparatus including the authentication token as a query character string. In this case, the PC **400** outputs (transmits) the MFP identifier as the value of the cookie to the relay apparatus **200**.

By receiving the authentication token from the PC **400**, the relay apparatus **200** can determine that the authentication procedure has been performed between the PC **400** and the external service **500**. Then, on the basis of the MFP identifier got as the value of the cookie, the relay apparatus **200** reads the callback URL of the MFP corresponding to the MFP identifier, from the MFP identifier table **204***c*. Next, in STEP U**311**, the relay apparatus **200** transmits a redirection command including the designated callback URL of the MFP, with the authentication token, to the PC **400**, so as to instruct the PC **400** to transmit the authentication token to the MFP **100**.

In STEP U**312**, on the basis of the redirection command, the PC **400** accesses the callback URL of the MFP connected with the PC **400** through the LAN and transmits the authentication token. Upon getting the authentication token, the MFP **100** stores the got authentication token in the authenti-

cation token memory **104***a*. Then, in STEP U**313**, the MFP **100** transmits a notification representing that the setting has been completed, to the PC **400**.

According to the present exemplary embodiment, the user can perform the authentication procedure with the external service **500**, using the web browser **400***a* of the PC **400**. If the authentication procedure is successful, the external service **500** issues the authentication token and transmits the authentication token to the MFP **100** through the relay apparatus **200** and the PC **400**. Therefore, even in a case where the MFP **100** has no web browser, it is possible to enable the MFP **100** to easily get the authentication token. Further, in the case where the MFP **100** has no web browser, high processing capacity is not required, and thus it is possible to suppress the manufacturing cost of the MFP **100**.

In a case of obtaining authentication with a password or an account name to use the external service **500**, a web browser is often required for displaying a login page. However, according to the MFP **100** of the present exemplary embodiment, the authentication can be obtained with an authentication token instead of the password or the account name. Therefore, even if there is no web browser so that any login page cannot be displayed, it is possible to obtain the authentication of the external service **500**.

Further, according the present exemplary embodiment, the relay apparatus **200** gets the callback URL of the MFP on the basis of the MFP identifier got as the value of the cookie and transmits the redirection command including the designated callback URL of the MFP to the PC **400**. Therefore, even if the web browser **400***a* of the PC **400** is a general-purpose web browser, it is possible to make the PC **400** transmit an authentication token to the MFP **100**.

FIG. **4** is a sequence diagram illustrating the OAuth communication sequence of STEP U**308**. As described with reference to FIG. **3**, upon receiving the screen data of the service selection screen from the relay apparatus **200** in STEP U**307**, on the basis of the received screen data, the PC **400** displays the service selection screen by the function of the web browser **400***a*. The screen data is generated in a markup language such as HTML, an XML text, or the like, and includes a designation URL **520** (which will be described later with reference to FIG. **5**C). The service selection screen is a screen for enabling the user to select any one from the services existing on the Internet **600**.

Next, in STEP U**401**, the PC **400** transmits a registration start request for the service selected from the services displayed as choices on the service selection screen by the user, to the relay apparatus **200**.

FIG. **5**C is a view illustrating an example of the designation URL **520** included in the registration start request. The designation URL **520** includes a character string (for example, 'service**1**') designating an external service and is associated with a choice of the service selection screen as a link. When the user clicks a choice on the service selection screen of the PC **400**, the PC **400** transmits a registration start request including the designation URL **520** that is a link associated with the corresponding choice, to the relay apparatus **200**.

Upon receiving the registration start request, in STEP U**402**, the relay apparatus **200** transmits a request-token acquisition request to the external service **500** that provides the service selected in the PC **400** (that is, the service designated by the designation URL **520** received by the relay apparatus **200**). In STEP U**403**, in response to the request-token acquisition request, the external service **500** transmits a request token to the relay apparatus **200**. Incidentally, according to the kind of the external service **500**, transmission and reception of a request token may be unnecessary. Next, in STEP U**404**, the relay apparatus **200** transmits a redirection command for a URL of a login page disclosed by the external service **500**, to the PC **400** which is the registration start requestor. This redirection command includes the request token received from the external service **500** by the relay apparatus **200**, and the callback URL of the relay apparatus. FIG. **5**D is a view illustrating an example of a callback URL **530** of a relay apparatus.

Referring to FIG. **4** again, the description will continue. Upon receiving the redirection command, in STEP U**405**, the PC **400** accesses the URL of the login page of the external service **500** and transmits the request token received from the relay apparatus **200**, to the external service **500**. In STEP U**406**, the external service **500** transmits the login page to the PC **400** which is the request token transmitter. The login page is a web page having input boxes for an account name and a password.

When the account name and the password registered for the service are input in the login page displayed in the PC **400** in STEP U**407**, in STEP U**408**, the PC **400** transmits the account name and the password to the external service **500**. In STEP U**409**, the external service **500** checks whether those account name and password correspond to the combination of the account name and the password issued in advance for the service. If it is determined that those account name and password correspond to the combination of the account name and the password issued in advance for the service, in STEP U**409**, the external service **500** transmits a permission confirmation page to the PC **400**. This permission confirmation page is a web page for inquiring of the user about whether to permit the relay apparatus **200** to use the external service **500** with the input account name.

If the user of the PC **400** permits the relay apparatus **200** to use the external service **500** in the permission confirmation page in STEP U**410**, in STEP U**411**, the PC **400** transmits a permission notification to the external service **500**. Then, the authentication procedure between the PC **400** and the external service **500** is completed, and the external service **500** issues the authentication token in STEP U**309** of FIG. **3**.

FIG. **6** is a flow chart illustrating a relay process that is performed by the relay apparatus **200**. The relay process is performed in accordance with the communication program **204***a* by the CPU **201**, and is a process for implementing the authentication-token getting sequence shown in FIG. **3**. This process is repeatedly performed during start-up of the relay apparatus **200**.

First, if the service-selection-screen URL request is received from the MFP **100** (Yes in STEP S**601**), in STEP S**602**, the CPU **201** gets the callback URL of the MFP received with the corresponding request. Specifically, as described with reference to FIG. **5**A, the designation URL **501** included as a destination in the service-selection-screen URL request includes the request reception URL **502**. Therefore, in a case where the received designation URL includes the request reception URL **502**, the CPU **201** performs the process of STEP S**602** and the subsequent processes. Then, the CPU **201** recognizes the character string next to '=' in the query character string **503** included in the designation URL **501**, as the callback URL **505**. Incidentally, since the callback URL **505** is a result of the URL encoding, the CPU **201** decodes the character string recognized as the callback URL **505** so as to get the callback URL of the MFP. Next, in STEP S**603**, the CPU **201** generates the MFP identifier and stores the MFP identifier in association with the callback URL of the MFP in the MFP identifier table **204***c*. Subsequently, the CPU **201** transmits the service selection screen URL and the MFP identifier to the MFP **100**. Specifically, in STEP S**604**, the

CPU **201** adds the query character string **511** representing the MFP identifier as a parameter, to the service selection screen URL **510** so as to generate an URL (see FIG. **5**B), and transmits the URL to the MFP **100**. Then, the CPU **201** returns to STEP S**601**.

If there is no service-selection-screen URL request (No in STEP S**601**) and there is access of the PC **400** to the service selection screen URL (Yes in STEP S**605**), specifically, if a request having the URL received from the PC **400** as a destination is received, in STEP S**606**, the CPU **201** gets the MFP identifier included as the query character string **511** in the URL received from the PC **400**. Next, the CPU **201** sets the MFP identifier as the value of the cookie in STEP S**607** and transmits the screen data of the service selection screen and the cookie to the PC **400** in STEP S**608**. Then, the CPU **201** returns to STEP S**601**.

If there is no access to the service selection screen URL (No in STEP S**605**) and a service registration start request is received (Yes in STEP S**609**), specifically, if a request having the designation URL **520** described with reference to FIG. **5**C as a destination is received, the CPU **201** requests a request token from the external service **500** in STEP S**610** and gets the request token transmitted from the external service **500** in response to the corresponding request in STEP S**611**. For example, the external service **500** transmits an XML text including the request token to the relay apparatus **200**. The CPU **201** reads the request token from the XML text. Next, in STEP S**612**, the CPU **201** transmits a redirection command for the URL of the login page disclosed by the external service **500**, to the PC **400** which is the registration start requestor. This redirection command includes the URL of the login page as a redirection destination. The URL of the login page includes: a query character string (not shown) representing the callback URL **530** of the relay apparatus; and a query character string representing the request token got in STEP S**611**. Then, the CPU **201** returns to STEP S**601**.

If there is no service registration start request (No in STEP S**609**) and there is access of the PC **400** to the callback URL **530** of the relay apparatus **200** (Yes in STEP S**613**), in STEP S**614**, the CPU **201** gets the authentication token transmitted from the PC **400**. Specifically, the CPU **201** reads the authentication token included as the query character string in the callback URL **530** of the relay apparatus **200** included in the HTTP message received from the PC **400**. Then, in STEP S**615**, the CPU **201** gets the MFP identifier from the cookie included in the header of the HTTP message received from the PC **400** and extracts the callback URL of the MFP corresponding to the MFP identifier, from the MFP identifier table **204***c*. Next, in STEP S**616**, the CPU **201** transmits the redirection command having the callback URL designated as a destination, and the authentication token, to the PC **400**. Incidentally, if the PC **400** receives the redirection command from the relay apparatus **200**, the PC **400** transmits the authentication token to the MFP **100** corresponding to the callback URL included in the redirection command. Then, the CPU **201** returns to STEP S**601**. If there is no access to the callback URL **530** of the relay apparatus (No in STEP S**613**), the CPU **201** performs another process in STEP S**617** and returns to STEP S**601**.

FIG. **7** is a flow chart illustrating a command performing process that is performed by the CPU **101** of the MFP **100**. The command performing process is repeatedly performed after a power supply of the MFP **100** is activated, and is a process for implementing the authentication-token getting sequence shown in FIG. **3**.

First, if there is a service-selection-screen URL request from the PC **400** (Yes in STEP S**701**), the CPU **101** transmits the service-selection-screen URL request and the callback URL of the MFP to the relay apparatus **200**. Specifically, the MFP **100** stores the request reception URL **502** of the relay apparatus **200** in advance, and the MFP **100** adds the query character string **503** including the encoded callback URL of the MFP as a parameter after the request reception URL **502**, so as to generate the designation URL **501**. Then, in STEP S**702**, the CPU **101** transmits the service-selection-screen URL request to the designation URL **501** (FIG. **5**A). Next, in STEP S**703**, the CPU **101** gets the service selection screen URL transmitted from the relay apparatus **200** and the MFP identifier included in the service selection screen URL. Then, the CPU **101** transmits the redirection command including the service selection screen URL (see FIG. **5**B) including the MFP identifier, to the PC **400**, in STEP S**704**, and returns to STEP S**701**.

If there is no service-selection-screen URL request (No in STEP S**701**) and there is no access to the callback URL of the MFP (Yes in STEP S**705**), the CPU **101** gets the authentication token transmitted from the PC **400** in STEP S**706** and stores the authentication token in the authentication token memory **104***a* in STEP S**707**. Then, the CPU **101** transmits the notification representing that the setting has been completed, in STEP S**708**, and returns to STEP S**701**.

If there is no access to the callback URL of the MFP (No in STEP S**705**), in STEP S**709**, the CPU **101** performs another process. For example, the CPU **101** may use the got authentication token to perform a process using the external service **500**.

According to the first exemplary embodiment, even if the MFP **100** has no web browser, it is possible to make the MFP **100** to easily get the authentication token.

Referring to FIG. **8**, a second exemplary embodiment of the present invention will now be described. A block diagram illustrating an electrical configuration of a service cooperation system **10** of the second exemplary embodiment is the same as that of the first exemplary embodiment, and thus description and illustration thereof will be omitted. Identical components of the second exemplary embodiment to those of the first exemplary embodiment are denoted by the same reference symbols, and detailed description thereof will be omitted.

FIG. **8** is a sequence diagram illustrating an authentication-token getting sequence, and corresponds to FIG. **3**. The authentication-token getting sequence shown in FIG. **8** is the same as that of the first exemplary embodiment, except that STEPS U**802** to U**807** are performed instead of STEPS U**302** to U**307** of the first exemplary embodiment shown in FIG. **3**.

In the above-described first exemplary embodiment, when requesting the service selection screen URL from the relay apparatus **200**, the MFP **100** transmits the callback URL of the MFP to the relay apparatus **200** in STEP U**302** and receives the service selection screen URL including the MFP identifier in STEP U**304**. On the other hand, in the second exemplary embodiment, when requesting the service selection screen URL, in STEP U**802**, the MFP **100** does not transmit the callback URL of the MFP to the relay apparatus **200**. Further, in STEP U**803**, the MFP **100** does not add the MFP identifier to the service selection screen URL received from the relay apparatus.

Instead, in STEP U**804**, the MFP **100** of the second exemplary embodiment adds the callback URL of the MFP to the service selection screen URL to be transmitted to the PC **400**, so as to output the callback URL of the MFP. Specifically, the MFP **100** adds a query character string including the encoded callback URL of the MFP to the service selection screen URL received from the relay apparatus **200** and transmits the ser-

vice selection screen URL to the PC **400**. Then, when the PC **400** accesses the service selection screen URL received from the MFP **100** and requests a service selection screen, in STEP U**805**, the PC **400** transmits the service selection screen URL (the service selection screen URL including the query character string representing the callback URL of the MFP) to the relay apparatus **200**.

That is, according to the second exemplary embodiment, when receiving a request based on the service selection screen URL from the PC **400**, the relay apparatus **200** gets the callback URL of the MFP included in the service selection screen URL. Then, the relay apparatus **200** stores the got callback URL of the MFP in the MFP identifier table **204***c*. Next, in STEP U**806**, the relay apparatus **200** generates the MFP identifier and stores the MFP identifier in association with the callback URL of the MFP in the MFP identifier table **204***c*.

Next, in STEP S**807**, the relay apparatus **200** instructs the web browser **400***a* to set a cookie when the relay apparatus **200** transmits the screen data corresponding to the service selection screen URL to the PC **400**, and to transmit the MFP identifier as the value of the cookie when the PC **400** transmits data to the relay apparatus **200**. Then, whenever the relay apparatus **200** receives a HTTP message from the PC **400**, the relay apparatus receives the MFP identifier and gets the callback URL of the MFP connected to the PC **400** through the LAN on the basis of the MFP identifier.

According to the second exemplary embodiment, it is possible to make the relay apparatus **200** get the callback URL of the MFP transmitted to the PC **400** by the MFP **100**, through the PC **400**. Therefore, the relay apparatus **200** can use the callback URL of the MFP to enable the MFP **100** to get the authentication token, and thus can achieve the same effects as those of the first exemplary embodiment.

Referring to FIG. **9**, a third exemplary embodiment will now be described. A block diagram illustrating an electrical configuration of a service cooperation system **10** of the third exemplary embodiment is the same as that of the first exemplary embodiment, and thus description and illustration thereof will be omitted. Identical components of the third exemplary embodiment to those of the first exemplary embodiment are denoted by the same reference symbols, and detailed description thereof will be omitted.

FIG. **9** is a sequence diagram illustrating an authentication-token getting sequence, and corresponds to FIG. **3**. The authentication-token getting sequence shown in FIG. **9** is the same as that of the first exemplary embodiment except that STEPS U**900** to U**904** are performed instead of STEPS U**311** and U**312** of the first exemplary embodiment shown in FIG. **3**.

In the above-described first exemplary embodiment, the relay apparatus **200** receives the authentication token from the PC **400** and transmits the authentication token to the MFP **100** through the PC **400** in STEPS U**310** to U**312**. On the other hand, in the third exemplary embodiment, upon receiving the authentication token from the PC **400** in STEP U**310**, in STEP U**900**, the relay apparatus **200** stores the received authentication token in the HDD **204** (FIG. **1**). Further, in STEP U**900**, the relay apparatus **200** generates information corresponding to the authentication token (hereinafter, referred to as authentication-token correspondence information) and stores the authentication-token correspondence information in association with the authentication token in the HDD **204**. Then, the relay apparatus **200** transmits the redirection command, which includes the callback URL of the MFP designated as a redirection destination, and the authentication-token correspondence information to the PC **400**. Specifically, the relay apparatus **200** adds a query character string including the authentication-token correspondence information to the callback URL of the MFP designated as the redirection destination, and the relay apparatus **200** transmits the callback URL of the MFP. Then, the relay apparatus **200** can instruct the PC **400** to transmit the authentication-token correspondence information to the MFP **100** in STEP U**901**.

Next, on the basis of the redirection command, in STEP U**902**, the PC **400** accesses the callback URL of the MFP connected to the PC **400** through the LAN and transmits the authentication-token correspondence information. Specifically, the PC **400** transmits the callback URL of the MFP including in the query character string including the authentication-token correspondence information. Then, the MFP **100** gets the authentication-token correspondence information from the query character string and stores the authentication-token correspondence information in the flash memory **104**. Then, the MFP **100** transmits the notification representing that the setting has been completed, to the PC **400**, in STEP U**313**.

Then, in a case where the MFP **100** accesses the external service **500**, as advance preparation, in STEP U**903**, the MFP **100** transmits the authentication-token correspondence information to the relay apparatus **200** so as to request the authentication token. Meanwhile, when receiving the authentication-token correspondence information from the MFP **100**, in STEP U**904**, the relay apparatus **200** reads the authentication token, which is stored in association with the authentication-token correspondence information, and transmits the authentication token to the MFP **100**. The MFP **100** can use the authentication token received from the relay apparatus **200** to access the external service **500**.

According to the third exemplary embodiment, it is possible to enable the MFP **100** to get the authentication token, and thus achieve the same effects as those of the first exemplary embodiment. The MFP **100** may store the authentication-token correspondence information instead of the authentication token. Therefore, for example, in a case where the data size of the authentication token issued by the external service **500** exceeds the capacity of the authentication token memory **104***a* provided in the MFP **100**, the relay apparatus **200** may generate the authentication-token correspondence information, which has a data size smaller than that of the authentication token, and transmit the authentication-token correspondence information to the MFP **100**.

In the above-described exemplary embodiments, the service cooperation system **10** is an example of the communication system, the MFP **100** is an example of the communication apparatus, and the PC **400** is an example of the browser-installed device. The web browser **400***a* is an example of a browser unit. The Internet **600** is an example of a network. The LAN I/F **105** of the MFP **100** is an example of a connecting unit, a first transmitting process, and an outputting process. The LAN I/F **205** of the relay apparatus **200** is an example of a first receiving process and a second transmitting process. The service selection screen URL is an example of data location information. The callback URL of the MFP is an example of the communication-device location information. The MFP identifier is an example of the correspondence information. The CPU **201** executing step S**602** is an example of a first getting process. The CPU **201** executing step S**608** is an example of a first instructing process. The CPU **201** executing step S**615** is an example of a second getting process. The CPU **201** executing step S**616** is an example of a second instructing process. The CPU **101** executing step S**703** is an example of a data-location-information getting process. The CPU **101** executing step S**702** is an example of a data-location-information requesting process. The CPU

201 executing step S603 is an example of a second storage control process and a second correspondence-information generating process. The CPU 201 executing step S604 is an example of a data-location-information transmitting process. In the second exemplary embodiment, the CPU 201 executing step S806 is an example of a first storage control process and a first correspondence-information generating process.

Although the present invention has been described on the basis of the exemplary embodiments, it is easily inferable that the present invention is not limited to the above-described exemplary embodiments. Various modifications for improvement can be made without departing from the scope of the invention.

For example, in the above-described exemplary embodiments, the MFP 100 is an example of the communication device; however, various devices such as a portable phone and a digital camera can be examples of the communication device. Further, the relay apparatus may be a virtual machine (for example, EC2 of Amazon (a registered trademark)) acting as a server in cooperation with a plurality of physical apparatuses, or may be a known rental server.

In the above-described exemplary embodiments, the relay apparatus 200 instructs the PC 400 to generate the MFP identifier corresponding to the callback URL of the MFP and transmit the MFP identifier as the value of the cookie to the relay apparatus 200. However, the above-described exemplary embodiments may be modified such that the callback URL of the MFP is set as the value of the cookie.

For example, with respect to the first exemplary embodiment shown in FIG. 3, if the relay apparatus 200 receives the callback URL of the MFP from the MFP 100 in STEP U302, the relay apparatus 200 may add the callback URL of the MFP as the parameter of the query character string to the service selection screen URL to be transmitted to the MFP 100 without storing the callback URL of the MFP (that is, without performing STEP U303). Then, the relay apparatus 200 transmits the service selection screen URL to the PC 400 through the MFP 100 in STEP U305, and the PC 400 transmits the service selection screen URL to the relay apparatus 200 in STEP U306. Upon receiving the service selection screen URL, the relay apparatus 200 may get the callback URL of the MFP from the service selection screen URL, set the callback URL of the MFP as the value of the cookie, and transmit the callback URL of the MFP, in STEP U307.

Similarly, with respect to the second exemplary embodiment shown in FIG. 7, the relay apparatus 200 may get the callback URL of the MFP from the service selection screen URL, without storing the callback URL of the MFP (that is, without performing STEP U806), and set the callback URL of the MFP as the value of the cookie in STEP U807.

According to this modification, the callback URL of the MFP is stored as the value of the cookie in the PC 400, and whenever the PC 400 transmits an HTTP message to the relay apparatus 200, the callback URL of the MFP is also transmitted. Therefore, the MFP identifier table 204*c* may be provided to the relay apparatus 200, or since it is not required to generate the MFP identifier, it is possible to reduce a load on the relay apparatus 200. As a result, it is possible to suppress the operational cost of the relay apparatus 200 or the equipment investment cost for the relay apparatus 200.

In the above-described exemplary embodiments, the MFP 100 that is an example of the communication device has no web browser installed therein; however, the present invention can be applied to a communication device having a web browser installed therein.

In the above-described exemplary embodiments, the example of setting the MFP identifier as the value of the cookie and transmitting the MFP identifier to the PC 400 have been described as an example of 'instructing the browser-installed device to output the communication-device location information or the correspondence information corresponding to the communication-device location information got as the communication-device location information of the communication device connected to the browser-installed device by the first getting process, to the relay apparatus.' In this case, the browser-installed device can include the MFP identifier in the HTTP message to be transmitted to the relay apparatus and transmit the HTTP message to the relay apparatus. Alternatively, for example, the communication-device location information or the correspondence information may be added as the parameter of the query character string to the callback URL 530 of the relay apparatus, and the browser-installed device may be instructed to transmit that value to the relay apparatus. Alternatively, the communication-device location information or the correspondence information may be embedded in a HTML to be transmitted from the relay apparatus to the browser-installed device, and the browser-installed device may be instructed to transmit the value of that information to the relay apparatus.

In the above-described exemplary embodiments, the callback URL of the MFP or the authentication-token correspondence information is included in the query character string added to the URL, which is transmitted. However, the above-described exemplary embodiments may be modified such that the callback URL of the MFP or the authentication-token correspondence information is included in a packet by another means, and the packet is output from the communication device.

In the above-described exemplary embodiments, as an example of the communication-device location information, the callback URL of the MFP has been exemplified; however, the communication-device location information may be an IP address. In this case, the relay apparatus 200 needs a process of adding a character string stored in advance, to the IP address got in STEP U302 or U805, so as to get the callback URL of the MFP 100.

In the third exemplary embodiment, the relay apparatus 200 stores the authentication token received from the PC 400, and the authentication-token correspondence information corresponding to the authentication token, in association with each other, and transmits the authentication token stored in association with the authentication-token correspondence information if receiving the corresponding authentication-token correspondence information from the MFP 100. Alternatively, if receiving the authentication token from the PC 400, the relay apparatus 200 may generate the authentication-token correspondence information in accordance with a rule predetermined with respect to the corresponding authentication token so as to transmit the authentication-token correspondence information to the MFP 100. Then, if receiving the authentication-token correspondence information from the MFP 100, the relay apparatus 200 may generate the authentication token in accordance with a rule and transmit the authentication token to the MFP 100.

What is claimed is:

1. A communication system comprising a communication device and

a relay apparatus,

wherein the communication device and the relay apparatus are connected to a network that an external service is connected to,

wherein the communication device comprises:

a communication unit configured to be connected to the network and to a web-browser enabled device,

wherein the web-browser enabled device comprises a browser unit, and wherein the web-browser enabled device is connected to the network; and

a communication device controller configured to perform:

a first transmitting process of, in response to receiving from the web-browser enabled device a first request for data location information, transmitting to the web-browser enabled device the data location information representing a location of predetermined data, wherein the web-browser enabled device is connected to the communication device via the communication unit over the network; and

an outputting process of outputting communication-device location information representing a location of the communication device, and

a data-location-information obtaining process of obtaining the data location information from the relay apparatus,

wherein upon receiving the first request for the data location information from the web-browser enabled device, the first transmitting process transmits, to the web-browser enabled device, the data location information obtained by the data-location-information obtaining process;

wherein the relay apparatus comprises:

a relay apparatus communication unit configured to be connected to the network; and

a relay apparatus controller configured to perform:

a first receiving process of receiving, from the web-browser enabled device, a second request based on the data location information;

a second transmitting process of transmitting to the web-browser enabled device the predetermined data in response to receiving the second request, the second request is received in the first receiving process based on the data location information;

a first obtaining process of obtaining the communication-device location information outputted by the communication device, the communication device is connected to the web-browser enabled device;

a first instructing process of instructing the web-browser enabled device to output, to the relay apparatus, (a) the communication-device location information of the communication device connected to the web-browser enabled device, wherein the communication-device location information obtained by the first obtaining process, (b) or correspondence information corresponding to said communication-device location information, wherein the web-browser enabled device is connected to the communication device via the communication unit over the network;

a second receiving process of receiving, from the web-browser enabled device, authentication data of the external service;

a second obtaining process of, in response to receiving the authentication data in the second receiving process, obtaining (a) the communication-device location information outputted by the web-browser enabled device or (b) the correspondence information corresponding to the communication-device location information and outputted by the web-browser enabled device; and

a second instructing process of instructing the web-browser enabled device to transmit the authentication data to the communication device, the communicating device being represented by the communication-device location information obtained by the second obtaining process.

2. The communication system according to claim **1**,

wherein the relay apparatus further comprises a storage unit configured to store the predetermined data, and

wherein when the first receiving process receives the second request based on the data location information, the second transmitting process transmits the predetermined data read from the storage unit to the web-browser enabled device.

3. The communication system according to claim **1**,

wherein the predetermined data includes designation information designating the external service.

4. The communication system according to claim **1**,

wherein when receiving the first request for data location information from the web-browser enabled device, the data-location-information obtaining process obtains the data location information from the relay apparatus, and

wherein the first transmitting process transmits the data location information obtained by the data-location-information obtaining process to the web-browser enabled device that has requested the data location information.

5. The communication system according to claim **1**,

wherein in the communication device, the outputting process further outputs the communication-device location information by adding the communication-device location information to the data location information to be transmitted to the web-browser enabled device by the first transmitting process, and

wherein in the relay apparatus, upon receiving the second request based on the data location information from the web-browser enabled device, the first obtaining process obtains the communication-device location information added to the data location information.

6. The communication system according to claim **5**,

wherein the relay apparatus controller further performs:

a first storage control process of storing the communication-device location information, obtained by the first obtaining process, in a storage unit; and

a first correspondence-information generating process of generating the correspondence information corresponding to the communication-device location information stored by the first storage control process, and

wherein the first instructing process instructs web-browser enabled device to output the correspondence information generated by the first correspondence-information generating process to the relay apparatus when the browser-installed device transmits data to the relay apparatus.

7. The communication system according to claim **1**,

wherein the communication device controller further performs a data-location-information requesting process of transmitting a third request for the data location information to the relay apparatus,

wherein the outputting process further transmits the communication-device location information to the relay apparatus when the data-location-information requesting process transmits the third request for the data location information to the relay apparatus, and

wherein in the relay apparatus, the first obtaining process further obtains the communication-device location information transmitted from the communication device when receiving the first request for the data location information from the communication device.

8. The communication system according to claim 7,
wherein the relay apparatus controller further performs:
a second storage control process of storing the communication-device location information, obtained by the first obtaining process, in a storage unit;
a second correspondence-information generating process of generating correspondence information corresponding to the communication-device location information stored by the second storage control process; and
a data-location-information transmitting process of transmitting the data location information including the correspondence information generated by the second correspondence-information generating process to the communication device,
wherein in the communication device, the first transmitting process further transmits to the web-browser enabled device the data location information including the correspondence information received from the relay apparatus, and
wherein in the relay apparatus,
the first receiving process receives the second request based on the data location information including the correspondence information, and
when the first receiving process receives the data location information including the correspondence information, the first instructing process instructs the web-browser enabled device to output the correspondence information to the relay apparatus.

9. The communication system according to claim 1,
wherein the first instructing process instructs the browser unit of the web-browser enabled device to output, to the relay apparatus, the communication-device location information or the correspondence information corresponding to the communication-device location information.

10. A communication system comprising a communication device and
a relay apparatus,
wherein the communication device and the relay apparatus are connected to a network that an external service is connected to,
wherein the communication device comprises:
a communication unit configured to be connected to the network and to a web-browser enabled device, wherein the web-browser enabled device comprises a browser unit, and wherein the web-browser enabled device is connected to the network; and
a communication device controller configured to perform:
a first transmitting process of, in response to receiving, from the web-browser enabled device a first request for data location information, transmitting to the web-browser enabled device the data location information representing a location of predetermined data, wherein the web-browser enabled device is connected to the communication device via the communication unit over the network, and
an outputting process of outputting communication-device location information representing a location of the communication device,
a data-location-information obtaining process of obtaining the data location information from the relay apparatus, and
wherein upon receiving the first request for the data location information from the web-browser enabled device, the first transmitting process transmits, to the web-browser enabled device, the data location information obtained by the data-location-information obtaining process;
wherein the relay apparatus comprises:
a relay apparatus communication unit configured to be connected to the network; and
a relay device controller configured to perform:
a first receiving process of receiving, from the web-browser enabled device, a second request based on the data location information;
a second transmitting process of transmitting to the web-browser enabled device the predetermined data in response to receiving the second request, the second request is received in the first receiving process based on the data location information;
a first obtaining process of obtaining the communication-device location information outputted by the communication device, the communication device is connected to the web-browser enabled device;
a first instructing process of instructing the web-browser enabled device to output, to the relay apparatus, (a) the communication-device location information of the communication device connected to the web-browser enabled device, wherein the communication-device location information obtained by the first obtaining process, (b) or correspondence information corresponding to said communication-device location information, wherein the web-browser enabled device is connected to the communication device via the communication unit over the network;
a second receiving process of receiving, from the web-browser enabled device, authentication data of the external service;
a second obtaining process of, in response to receiving the authentication data in the second receiving process, obtaining (a) the communication-device location information outputted by the web-browser enabled device or (b) the correspondence information corresponding to the communication-device location information and outputted by the web-browser enabled device; and
a second instructing process of instructing the web-browser enabled device to transmit correspondence authentication data corresponding to the authentication data to the communication device, the communication device being represented by the communication-device location information obtained by the second obtaining process; and
a third transmitting process of transmitting the authentication data corresponding to the correspondence authentication data when the correspondence authentication data is received from the communication device.

11. The communication system according to claim 10,
wherein the relay apparatus further comprises a storage unit configured to store the predetermined data, and
wherein when the first receiving process receives the second request based on the data location information, the second transmitting process transmits the predetermined data read from the storage unit to the web-browser enabled device.

12. The communication system according to claim 10,
wherein the predetermined data includes designation information designating the external service.

13. The communication system according to claim 10,
wherein when receiving the first request for data location information from the web-browser enabled device, the data-location-information obtaining process obtains the data location information from the relay apparatus, and
wherein the first transmitting process transmits the data location information obtained by the data-location-information obtaining process to the web-browser enabled device that has requested the data location information.

14. The communication system according to claim 10,
wherein in the communication device, the outputting process further outputs the communication-device location information by adding the communication-device location information to the data location information to be transmitted to the web-browser enabled device by the first transmitting process, and
wherein in the relay apparatus, upon receiving the second request based on the data location information from the browser-installed device, the first obtaining process obtains the communication-device location information added to the data location information.

15. The communication system according to claim 14,
wherein the relay apparatus controller further performs:
- a first storage control process of storing the communication-device location information, obtained by the first obtaining process, in a storage unit; and
- a first correspondence-information generating process of generating the correspondence information corresponding to the communication-device location information stored by the first storage control process, and

wherein the first instructing process instructs the web-browser enabled device to output the correspondence information generated by the first correspondence-information generating process to the relay apparatus when the web-browser enabled device transmits data to the relay apparatus.

16. The communication system according to claim 10,
wherein the communication device controller further performs a data-location-information requesting process of transmitting a third request for the data location information to the relay apparatus,
wherein the outputting process further transmits the communication-device location information to the relay apparatus when the data-location-information requesting process transmits the third request for the data location information to the relay apparatus, and
wherein in the relay apparatus, the first obtaining process further obtains the communication-device location information transmitted from the communication device when receiving the first request for the data location information from the communication device.

17. The communication system according to claim 16,
wherein the relay apparatus controller further performs:
- a second storage control process of storing the communication-device location information, obtained by the first obtaining process, in a storage unit;
- a second correspondence-information generating process of generating correspondence information corresponding to the communication-device location information stored by the second storage control process; and
- a data-location-information transmitting process of transmitting the data location information including the correspondence information generated by the second correspondence-information generating process to the communication device,

wherein in the communication device, the first transmitting process further transmits to the web-browser enabled device the data location information including the correspondence information received from the relay apparatus, and
wherein in the relay apparatus,
- the first receiving process receives the second request based on the data location information including the correspondence information, and
- when the first receiving process receives the data location information including the correspondence information, the first instructing process instructs the web-browser enabled device to output the correspondence information to the relay apparatus.

18. The communication system according to claim 10,
wherein the first instructing process instructs the browser unit of the web-browser enabled device to output, to the relay apparatus, the communication-device location information or the correspondence information corresponding to the communication-device location information.

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